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Application No. 7901325  
Filed 19 January 1979

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*A H W Kennard*  
A H W Kennard

for the Comptroller.



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I further certify that pursuant to Section 22(1) of the Patents Act, 1977, the Comptroller has ordered prohibition of publication of the said specification.

WITNESS my hand this 19 day of December 1979

C.O.C. 6

*Row kennard*

## PATENTS ACT 1977

PATENTS FORM NO. 1/77  
(Rules 6, 16, 19)

12 JAN 1979

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25 Southampton Buildings  
London WC2A 1AY

7901325

## REQUEST FOR THE GRANT OF A PATENT

THE GRANT OF A PATENT IS REQUESTED BY THE UNDERSIGNED ON THE BASIS OF THE PRESENT APPLICATION

I Applicant's or Agent's Reference (Please insert if available) NC NO. 55/78

II Title of Invention THRUST NOZZLE FOR A GAS TURBINE ENGINE

III Applicant or Applicants (See note 2)

Name (First or only applicant) .... Rolls-Royce Limited

Address ..... 65 Buckingham Gate, London, SW1E 6AT

Nationality .. A British Company

Name (of second applicant, if more than one) .....

Address .....

Nationality ..

IV Inventor (See note 3)

(a) The applicant(s) is/are the sole/joint inventor(s) or

(b) A statement on Patents Form No. 7/77 is/ will be furnished

V Authorisation of Agent (See note 4) G T KELVIE

VI Address for Service (See note 5) Company Patents &amp; Licensing Dept.

Rolls-Royce Limited, P O Box 31, Moor Lane,  
Derby, DE2 8BJ

Telephone Derby 42424 Ext 353

VII Declaration of Priority (See note 6)

Country .....

Filing date .....

File number .....

VIII The Application claims an earlier date under Section 8(3), 12(6), 15(4) or 37(4) (See note 7)

Earlier application or patent number ..... and filing date .....



**IX Check List (To be filled in by applicant or agent)**

A The application contains the following number of sheet(s)

- 1 Request ..... 1 Sheet(s)  
2 Description ..... 5 Sheet(s)  
3 Claim(s) ..... - Sheet(s)  
4 Drawing(s) ..... 1 Sheet(s)  
5 Abstract ..... - Sheet(s)

B The application as filed is accompanied by:-

- 1 Priority document.....  
2 Translation of priority document .....,  
3 Request for Search .....,  
4 Statement of Inventorship and Right to Apply .....  
5 Separate Authorisation of .....

**X** It is suggested that Figure No ..... of the drawings (if any) should accompany the abstract when published

**XI Signature (See note 8)**

For and on behalf of Rolls-Royce Limited

J C Purcell - Authorised by Power of Attorney

**NOTES:**

- 1 This form, when completed, should be brought or sent to the Patent Office together with the prescribed fee and two copies of the description of the invention.
- 2 The name, address and nationality of each applicant are to be stated in the spaces provided at III. Names of natural persons should be indicated in full. Bodies corporate should be designated by their corporate name. If there are more than two applicants the information concerning the third (and further) applicants should be given on a separate sheet.
- 3 Where the applicant or applicants is/are the sole inventor or the joint inventors, the declaration (a) to that effect at IV should be completed and the alternative statement (b) deleted. If however this is not the case the declaration (a) should be struck out and a statement will then be required to be filed upon Patents Form No.7/77.
- 4 If the applicant wishes to appoint an agent, his name and address of his place of business shall be indicated in the spaces available at V and VI; such indication will be considered to be an authorisation for the agent to prosecute the application up to grant of a patent and to service any patent so granted.
- 5 If no authorised agent is appointed an address for service in the United Kingdom to which all documents and notices may be sent must be stated at VI. It is recommended that a telephone number be provided if available.
- 6 The declaration of priority at VII should state the date of the previous filing and the country in which it was made and indicate the file number, if available.
- 7 When an application is made by virtue of section 8(3), 12(6), 15(4) or 37(4) the appropriate section should be identified at VIII and the number of the earlier application or any patent granted thereon identified.
- 8 An agent may sign only when previously authorised. An express authorisation signed by the applicant(s) must be received by the Patent Office before the expiry of 3 months from the filing date.
- 9 Attention of applicants is drawn to the desirability of avoiding publication of inventions relating to any article, material or device intended or adapted for use in war (Official Secrets Acts, 1911 and 1920). In addition after an application for a patent has been filed at the Patent Office the comptroller will consider whether publication or communication of the invention should be prohibited or restricted under section 22 of the Act and will inform the applicant if such prohibition is necessary.
- 10 Applicants resident in the United Kingdom are also reminded that, under the provisions of section 23 applications may not be filed abroad without written permission or unless an application has been filed not less than six weeks previously in the United Kingdom for a patent for the same invention and no direction prohibiting publication or communication has been given or any such direction has been received.

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[ROLLS-ROYCE LIMITED]

7901325

1979

[CASE NO.]

SHORT TITLE: PCB VARIABLE NOZZLE

[APPLICATION NO.]

[1ST APPLICATION]

[DATED:]

[PATENTS ACT 1977]

SPECIFICATION

THRUST NOZZLE FOR A GAS TURBINE ENGINE

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This invention concerns a thrust nozzle for a gas turbine engine.

More specifically, the invention is concerned with a thrust nozzle, the outlet area of which can be varied, so as to cater for varying volumes of gas flow from a gas turbine engine which includes the nozzles.

The invention seeks to provide a variable area nozzle structure suitable for use as inter alia, a thrust vectoring nozzle ie: one which is rotatable so as to emit propulsive gas flow in various directions.

According to the present invention, there is provided a variable area thrust nozzle for a gas turbine engine, comprising a tubular structure having an exhaust gas outlet, a flap pivotally mounted within said tubular structure so as to be movable between a position wherein its edges seal against the inner wall of the tubular structure, in which position the flap effectively reduces the outlet area of the nozzle, and a position wherein the flap lies parallel with said inner wall so that in operation, gas may flow both sides thereof and means for moving said flap between said positions.

Preferably the thrust nozzle is adapted for rotary movement relative to an engine to which for operation the nozzle is fitted and the nozzle outlet is angled with respect to the nozzle inlet.

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The moving means may comprise a powered ram linked to the flap underside, and supported from the external surface of the tubular structure.

Preferably the thrust nozzle is in the form of an elbow and the moving means is supported from the outer surface of the inside of the curve of the elbow.

The invention will now be described, by way of example and with reference to the accompanying drawings in which:

Figure 1 is a diagrammatic view of a gas turbine engine incorporating a pair of variable area thrust nozzles in accordance with an embodiment of the invention,

Figure 2 is an enlarged, cross-sectional part view of Figure 1.

In Figure 1 an aircraft power plant 10 comprises a core gas generator 12 driving a front fan 14. The fan duct 16 of front fan 14 terminates in a plenum chamber 18. The plenum chamber is divided into two portions 20, 22 each of which terminates in a respective propulsion nozzle 24, 26.

Propulsion nozzles 24, 26 are rotatable relative to the power plant 10, so as to enable thrust vectoring. In each nozzle, rotation is achieved by connecting the nozzles 24, 26 to the divided portions 20, 22 of plenum chamber 18, via bearings in respective housings 28, 30.

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Reheat equipment (not shown) is included in the plenum chamber 18 and operation of the reheat equipment requires the ability to increase the outlet area of each nozzle 24, 26 so as to cater for the resultant increased mass flow of gases.

Referring now to Figure 2, nozzle 24 is in the form of an elbow, so that its outlet 32 is in a plane which is approximately normal to the plane of rotation of the nozzle. A flap 34 is pivotally mounted at 36 in this nozzle 24 and its length extends inwardly from the outlet of the nozzle structure. The edge periphery 38 of flaps 34 is so shaped that when the flap is in the position shown in full lines, the edge periphery 38 seals against the inner wall of the nozzle. The effective outlet therefore, has a depth indicated between arrowheads 40. In the configuration first described, the outlet area of nozzle 24 is the smallest possible, but should re-heat be required, that area will not be sufficient to pass the resultant increase in mass flow of the gas.

Accordingly, flap 34 is pivoted to the position shown in dotted lines. Gas can then flow past both sides of flap 34, to the outlet plane 32 the depth of which has now been enlarged as indicated by the distance between arrowheads 42.

In the present example, a ram 44 is used to move the flap 34 between its two positions. The ram 44 is connected to the underside of flap 34 via a link and pin arrangement 46. However, any

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suitable linear actuator may be utilised.

A hole 48 is provided to enable the link portion of the connection 46 to pass through.

However, in the "reheat" configuration, no gas will escape to atmosphere via hole 48, as a sole plate 50 seals the hole therefrom. The sole plate also serves to locate ram structure 44.

The construction of area varying apparatus described hereinbefore, is particularly suitable for employment with elbow type nozzles, in that it can be positioned in the crook of the elbow, as shown and so does not add to the frontal area of the power plant it is mounted upon. Moreover, mounting the apparatus thus does not affect the structural integrity of the outer portion of the elbow, which in operation, is subject to the temperature and turning of the gas flow. However, as can be seen in Figure 1, the apparatus can be utilised on a straight nozzle.

In Figure 1 the outlet nozzle 52 of gas generator 12, has a flap 54 mounted therein in a manner identical with the flap 34 of Figure 2. A ram mechanism 56 lies along the exterior of nozzle 52 and is connected to flap 54 via a link 58.

Actuation of ram 56 pivots link 58 which in turn pivots flap 54 into the "reheat on" position.

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As link 58 will pivot about one portion of an arc and flap 54 will pivot about another portion of arc, the connection between them will have to comprise a pin and slot connection, to cater for the different movements.

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G T Kelvie

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CHARTERED PATENT AGENT and  
AGENT FOR THE APPLICANTS

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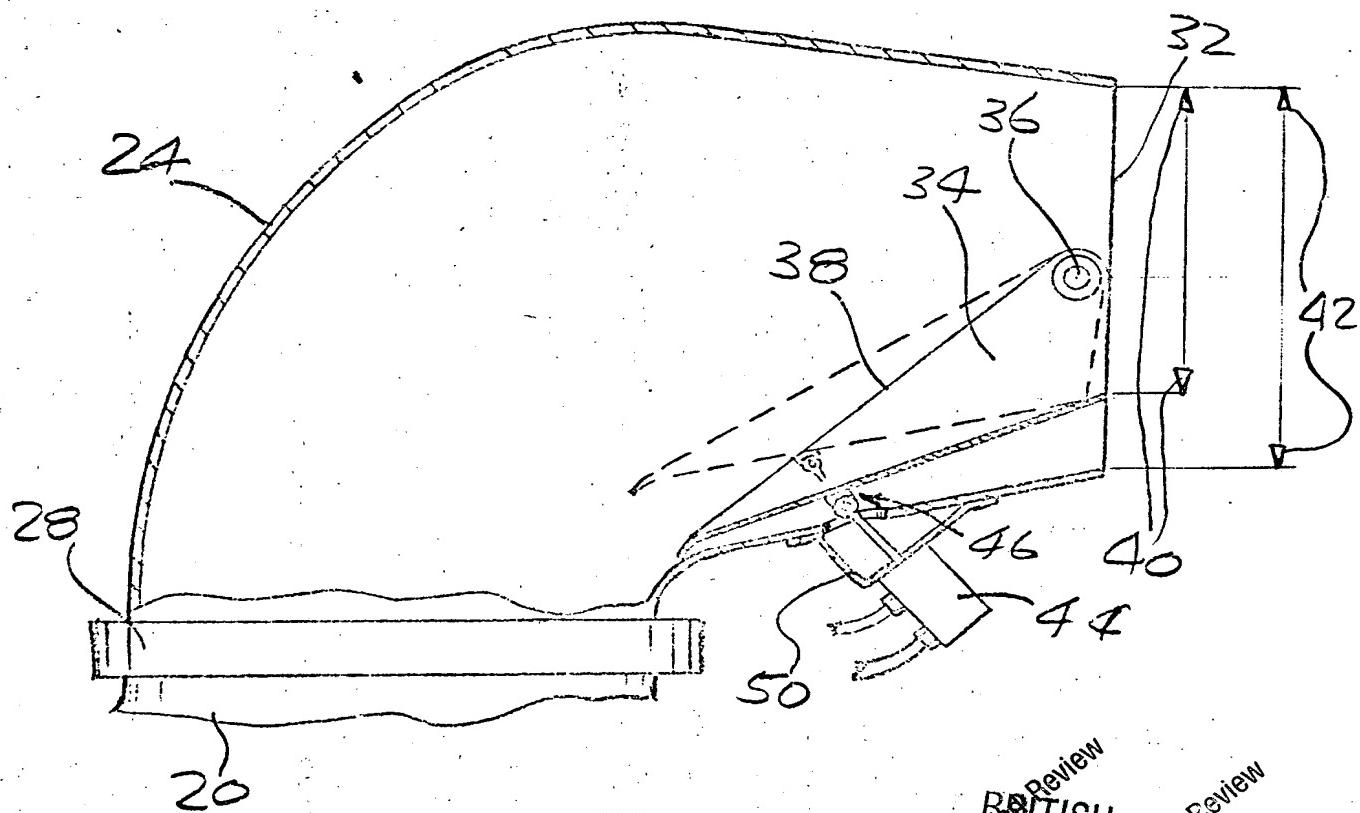
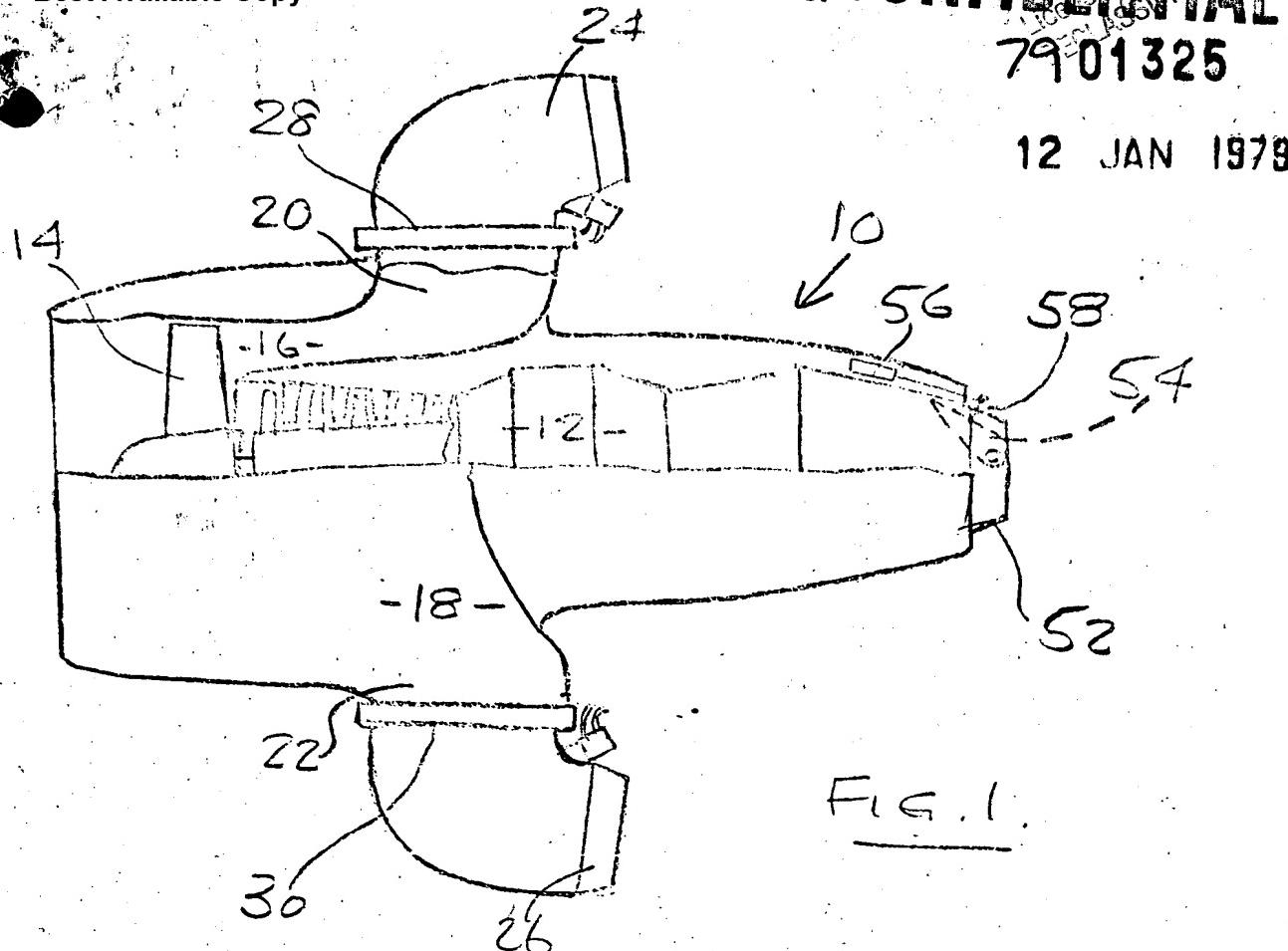


FIG. 2  
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